**THE CLAIMS**

1. (Previously presented) A nanoreactor, comprising:
a nanoreactor shell having a thickness of at least 0.5 nm,
said nanoreactor shell enveloping a space, wherein,
said nanoreactor shell is not perfectly single crystalline, further comprising
a nanoparticle disposed within the space, wherein the nanoreactor shell comprises a main group metal, transition metal, alkali metal, or alkaline earth metal.

2. (Original) The nanoreactor as claimed in claim 1, wherein:
the shell thickness is between about .5 nm and 100 nm.

3. (Original) The nanoreactor as claimed in claim 2, wherein:
the shell thickness is between about 2 nm and 80 nm.

4. (Original) The nanoreactor as claimed in claim 3, wherein:
the shell thickness is between about 3 nm and 10 nm.

5. (Original) The nanoreactor as claimed in claim 1, wherein:
the shell comprises a material selected from the group consisting of Pt, ZnS, ZnSe, ZnTe, ZnO, CoO, $Co_3O_4$ , $Fe_2O_3$, FeP, $Fe_3O_4$, FeO, $TiO_2$, CdS, CdSe, CdTe, HgS, HgSe, HgTe, MgTe, GaN, GaP, GaAs, GaSb, InN, InP, InAs, InSb, AlAs, AlP, AlSb, AlS, $Co_9S_8$, $Co_3S_4$, CoSe, GaMnAs, GaInN and InAsN.

6. (Original) The nanoreactor as claimed in claim 1, wherein:
the shell comprises a material selected from the group consisting of $Co_9S_8$, $Co_3S_4$, CoO, $Co_3O_4$, CoSe, CdS, $Fe_2O_3$, CdSe and Pt.

7. (Previously Presented) The nanoreactor as claimed in claim 5, wherein:
the shape of the nanoreactor is spherical, tubular or disk.

8. (Original) The nanoreactor as claimed in claim 7, wherein:
the shape of the nanoreactor is spherical, and
the outside diameter is between about 1 nm and 1000 nm.

9. (Original) The nanoreactor as claimed in claim 8, wherein:
the outside diameter is between 1 nm and 500 nm.

10. (Original) The nanoreactor as claimed in claim 9, wherein:
the outside diameter is between 5 nm and 100 nm.

11. (Original) The nanoreactor as claimed in claim 10, wherein:
the outside diameter is between 10 nm and 50 nm.

12. (Original) The nanoreactor as claimed in claim 11, wherein:
the outside diameter is between 10 nm and 30 nm.

13. (Previously presented) The nanoreactor as claimed in claim 1, wherein:
the nanoreactor shell comprises a binary or ternary compound,
wherein said binary or ternary compound comprises a first material and a second material, wherein:
the first material comprises a material selected from the group consisting of Pt, Zn, Co, Fe, Ti, Cd, Hg, Mg, Ga, In, Al, Ni, Sn and Bi; and
the second material is selected from the group consisting of S, Se, O, P, N, F, Cl, I, Br, As and Sb.

14. (Original) The nanoreactor as claimed in claim 13, wherein:
the diffusion rate for the first material is different than the diffusion rate

for the second material.

15. (Original) The nanoreactor as claimed in claim 7, wherein:
the nanoreactor shell has a disk shape, and
the outside diameter is between about 10 nm to about 200 nm.

16. (Original) The nanoreactor as claimed in claim 15, wherein:
the outside diameter is between about 10 nm and 100 nm.

17. (Original) The nanoreactor as claimed in claim 15, wherein:
the outside diameter is between about 25 nm and 50 nm.

18. (Previously Presented) The nanoreactor as claimed in claim 7, wherein:
the nanoreactor has a tubular shape, and
a length of the tubular shape is between about 30 nm to about 500 μm.

19. (Original) The nanoreactor as claimed in claim 18, wherein:
the length is between about 50 nm and 200 μm.

20. (Original) The nanoreactor as claimed in claim 19, wherein:
the length is between about 50 nm and 20 μm.

21. (Previously presented) A method of making a nanoreactor, comprising
providing a nanoparticle,
coating the nanoparticle with a first material,
reacting the first material with a second material,
wherein the first and second material react to form a nanoreactor shell
that envelopes a space within which the nanoparticle is disposed
and comprises a main group metal, transition metal, alkali metal, or
alkaline earth metal.

22. (Previously Presented) The method of making a nanoreactor as claimed in claim 21, wherein:

the first material comprises a material chosen from the group consisting of Al, Ga, In, Tl, Sn, Pb, Bi, Po, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, La, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr, Ba, Ge, Si, Se, Te, FeCo, CoNi and CdZn.

23. (Previously Presented) The method of making a nanoreactor as claimed in claim 21, wherein:

the second material comprises a material chosen from the group consisting of S, O, Se, Te, P, N, As, Cl, I, Br and Bi.

24. (Previously Presented) The method of making a nanoreactor as claimed in claim 23, wherein:

the second material comprises a material chosen from the group consisting of S, O, Se and Te.

25. (Previously Presented) The method of making a nanoreactor as claimed in claim 21, wherein:

the second material comprises sulfur in solution, and

the second material is combined with a solution containing the first material to make a sulfide nanoreactor.

26. (Previously presented) The method of making a nanoreactor as claimed in claim 21, wherein:

the second material comprises O, and

a gaseous mixture containing the second material is combined with a solution containing the first material,

thereby making an oxide nanoreactor compound.

27. (Previously Presented) The method of making a nanoreactor as claimed in claim 21, wherein:

the second material comprises O, and

and the second material is in solution and is combined with a solution containing the first material,

thereby making an oxide nanoreactor compound.

28. (Previously Presented) The nanoreactor as claimed in claim 1, wherein:

the nanoparticle comprises a material selected from the group consisting of Al, Ga, In, Tl, Sn, Pb, Bi, Po, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, La, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr, Ba, Ge, Si, Se, and Te.

29. (Original) The nanoreactor as claimed in claim 28, wherein the nanoparticle comprises Pt.

30. (Previously presented) A method of catalyzing a reaction, comprising:

contacting one or more reactants with a nanoreactor, the nanoreactor comprising:

a nanoreactor shell having a thickness of at least 0.5 nm,

said nanoreactor shell enveloping a space, wherein,

said nanoreactor shell is not perfectly single crystalline, further comprising

a nanoparticle disposed within the space, wherein the nanoreactor shell comprises a main group metal, transition metal, alkali metal, or alkaline earth metal; and producing one or more reaction products.

31. (Previously presented) A method of hydrodesulfurization, comprising:

contacting a compound comprising a thiophene moiety with a

nanoreactor, the nanoreactor comprising:

a nanoreactor shell having a thickness of at least 0.5 nm,

said nanoreactor shell enveloping a space, wherein,

said nanoreactor shell is not perfectly single crystalline, further comprising

a nanoparticle disposed within the space, wherein the nanoreactor shell comprises a main group metal, transition metal, alkali metal, or alkaline earth metal; and producing one or more hydrodesulfurization products.